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Attorney's Docket No.: 09991-042001

Amendments to the Claims:

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims:

1. (currently amended) Apparatus comprising:

a plurality of droplet ejection devices, each said droplet ejection device including  
a fluid chamber having a volume and an ejection nozzle,

an electrically actuated displacement device that moves between a displaced position and an undisplaced position to change said volume of said chamber as a capacitance associated with the electrically actuated displacement device changes in charge between an actuated condition and an unactuated condition, and

a first switch that has a first input connected to an electric source terminal, a first output connected to said electrically actuated displacement device, and a first control signal input to determine whether said first input is connected to or disconnected from said first output, ~~and an electric source that is connected to distribute~~ wherein an applied electric source distributes an electrical signal to said first inputs of said plurality of droplet ejection devices, and

a controller that provides respective charge control signals to respective said first control signal inputs to control ~~the~~ an extent of change in charge on respective said capacitances ~~by when the time that~~ the respective said first switch connects said electrical signal to the respective said electrically actuated displacement device and to set a constant amount of charge on respective said capacitances in the actuated condition when the respective said first switch disconnects said electrical signal to the respective said electrically actuated displacement device, wherein the disconnection maintains a constant voltage on respective said capacitances by storing the constant amount of charge on respective said capacitances.

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2. (original) The apparatus of claim 1 wherein said electrically actuated displacement device moves between a displaced position and an undisplaced position as a capacitance associated with the electrically actuated displacement device changes between a charged, actuated condition and an uncharged, unactuated condition, and

wherein said controller that provides respective charge control signals to respective said first control signal inputs to control the extent of charge placed on respective said capacitances by the time that the respective said first switch connects said electrical signal to the respective said electrically actuated displacement device.

3. (original) The apparatus of claim 2

wherein each said droplet ejection device also includes a second switch that has a second input connected to a discharging electrical terminal, a second output connected to said electrically actuated displacement device, and a second control signal input to determine whether said second input is connected to or disconnected from said second output, and

wherein said controller provides respective discharge control signals to respective said second control signal inputs to control discharge of the charge on said respective capacitances.

4. (original) The apparatus of claim 1 wherein each said droplet ejection device comprises a first resistance between said electric source and said electrically actuated displacement device.

5. (original) The apparatus of claim 3 wherein each said droplet ejection device comprises a second resistance between said discharging electrical terminal and said electrically actuated displacement device.

6. (original) The apparatus of claim 3 wherein each said droplet ejection device has a first resistance that is between said electrical source and said electrically actuated displacement device and is external of an electrical path from said electrically actuated displacement device to

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said second switch, and further comprising a second resistance that is included in the electrical path from said electrically actuated device to said discharging electrical terminal.

7. (original) The apparatus of claim 3 wherein a single resistance is used to charge and discharge a respective capacitance.

8. (original) The apparatus of claim 1 wherein a plurality of resistors, voltages and switches are connected to each said electrically actuated displacement device and controlled by said controller to change the charge on said capacitance.

9. (original) The apparatus of claim 3 wherein said discharging electrical terminal is at ground.

10. (original) The apparatus of claim 1 wherein said electrical signal is a controlled voltage signal.

11. (original) The apparatus of claim 1 wherein said electrical signal is a controlled current signal.

12. (original) The apparatus of claim 1 wherein said electrical signal is a constant current.

13. (currently amended) Apparatus comprising:  
a plurality of droplet ejection devices, each said droplet ejection device including  
a fluid chamber having a volume and an ejection nozzle,  
an electrically actuated displacement device that moves between a displaced position and an undisplaced position to change said volume of said chamber as a

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capacitance associated with the electrically actuated displacement device changes between a charged, actuated condition and an uncharged, unactuated condition, and

a first switch that has a first input connected to a voltage source terminal, a first output connected to said electrically actuated displacement device, and a first control signal input to determine whether said first input is connected to or disconnected from said first output, ~~and a voltage source that is connected to distribute~~ wherein a voltage source distributes a constant voltage electrical signal to said first inputs of said plurality of droplet ejection devices, and

a controller that provides respective charge control signals to respective said first control signal inputs to control ~~the~~ an extent of charge placed on respective said capacitances when by the time that the respective said first switch connects said electrical signal to the respective said electrically actuated displacement device and to set a constant amount of charge on respective said capacitances in the actuated condition when the respective said first switch disconnects said electrical signal to the respective said electrically actuated displacement device, wherein the disconnection maintains a constant voltage on respective said capacitances by storing the constant amount of charge on respective said capacitances.

14. (original) The apparatus of claim 13 wherein said first control signal terminates the connection of said constant voltage to said electrically actuated displacement device when the charge on said electrically actuated displacement device is at a predetermined value which is less than said constant voltage.

15. (original) The apparatus of claim 13 wherein each said droplet ejection device also includes a second switch that has a second input connected to a discharging electrical terminal, a second output connected to said electrically actuated displacement device, and a second control signal input to determine whether said second input is connected to or disconnected from said second output, and wherein said controller provides respective discharge control signals to

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respective said second control signal inputs to control discharge of the charge on said respective capacitances.

16. (original) The apparatus of claim 1 or 13 wherein electrically actuated displacement device is a piezoelectric actuator.

17. (original) The apparatus of claim 1 or 13 wherein said first control signals are controlled to provide uniform droplet volumes or velocities from said plurality of droplet ejection devices.

18. (original) The apparatus of claim 1 or 13 wherein said first control signals are controlled to provide predetermined different drop volumes or velocities from different droplet ejection devices so as to provide gray scale control.

19. (original) The apparatus of claim 3 or 15 wherein said first and second control signals are controlled to provide predetermined different drop volumes or velocities from different droplet ejection devices so as to provide gray scale control.

20. (original) The apparatus of claim 3 or 15 wherein said first and second control signals are controlled to connect said electrical signal to respective said electrically actuated displacement devices for respective predetermined times.

21. (original) The apparatus of claim 1 or 13 wherein respective said first control signals are controlled to connect said electrical signal to respective said electrically actuated displacement devices until respective said electrically actuated displacement devices achieve respective predetermined charge voltages.

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22. (original) The apparatus of claim 1 or 13 wherein said first control signals are controlled to provide a voltage that is insufficient to eject a droplet, but is sufficient to move a meniscus of a liquid at an ejection nozzle of said droplet ejection device.

23. (original) The apparatus of claim 3 or 15 wherein said first and second control signals are controlled to provide a voltage that is insufficient to eject a droplet, but is sufficient to move a meniscus of a liquid at an ejection nozzle of said droplet ejection device.

24. (original) The apparatus of claim 1 or 13 wherein said first control signals are controlled to inject noise into images being printed so as to break up possible print patterns and banding.

25. (original) The apparatus of claim 3 or 15 wherein said first and second control signals are controlled to inject noise into images being printed so as to break up possible print patterns and banding.

26. (original) The apparatus of claim 3 or 15 wherein said first and second control signals are controlled to vary the amplitude of charge as well as the length of time of charge on said electrically actuated displacement device for the first droplet out of a droplet ejection device so as to match subsequent droplets.

27. (original) The apparatus of claim 1 or 13 wherein said apparatus is an inkjet print head.

28. (currently amended) The apparatus of claim 1 or 13 wherein said controller includes a field programmable gate array on a circuit board mounted to a monolithic body in which said ~~pumping~~ fluid chambers are formed.

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29. (original) The apparatus of claim 1 or 13 wherein said controller controls said first switch as a function of the frequency of droplet ejection to reduce variation in drop volume as a function of frequency.

30. (new) A method to control a response of a droplet ejection device comprising a charging switch and a piezoelectric actuator, the method comprising:

controlling the charging switch for the piezoelectric actuator, wherein said charging switch comprises an input terminal to connect to an electrical source, an output terminal to connect to the piezoelectric actuator, and a control signal terminal to control an electrical connection or electrical disconnection between said electrical source and said piezoelectric actuator ;

generating an actuated condition for the piezoelectric actuator by controlling an extent of change in charge on a capacitance associated with the piezoelectric actuator when said charging switch forms an electrical connection between said electrical source and said piezoelectric actuator; and

maintaining the actuated condition for the piezoelectric actuator by setting a constant amount of charge on the capacitance when said charging switch electrically disconnects said electrical source and said piezoelectric actuator, wherein the disconnection maintains a constant voltage on said capacitance by storing the constant amount of charge on said capacitance.

31. (new) The method of claim 30 further comprising:

generating an unactuated condition for the piezoelectric actuator by activating a discharging switch that has a discharging input connected to a discharging electrical terminal, a discharging output connected to the piezoelectric device, and a discharging control signal input to determine whether said discharging input is electrically connected to or electrically disconnected from said discharging output; and

providing a discharge control signal to said discharging control signal input to control discharge of the charge on said capacitance.

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32. (new) The method of claim 31, wherein the amount of charge on the capacitance is greater in the actuated condition than the amount of charge in the unactuated condition.

33. (new) A method for dispensing fluid for a plurality of droplet ejection devices, the method comprising:

for each said droplet ejection device, moving an electrically actuated displacement device between a displaced position and an undisplaced position to change a volume of a fluid chamber as a capacitance associated with the electrically actuated displacement device changes in charge between an actuated condition and an unactuated condition;

for each said droplet ejection device, distributing an electric signal from an electric source to a first input of a first switch of said droplet ejection device, wherein the first input of the first switch connects to a terminal of the electric source, and a first output of the first switch connects to said electrically actuated displacement device;

for each said droplet ejection device, determining whether a first control signal input of the first switch forms an electrical connection or electrically disconnection between said first input and said first output; and

controlling respective charge control signals to respective said first control signal inputs, wherein the controlling comprises:

controlling an extent of change in charge on respective said capacitances when the respective said first switch connects said electrical signal to the respective said electrically actuated displacement device; and

setting a constant amount of charge on respective said capacitances in the actuated condition when the respective said first switch disconnects said electrical signal to the respective said electrically actuated displacement device, wherein the disconnection maintains a constant voltage on respective said capacitances by storing the constant amount of charge on respective said capacitances.



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34. (new) The method of claim 33 further comprising:

moving said electrically actuated displacement device between a displaced position and an undisplaced position as a capacitance associated with the electrically actuated displacement device changes between a charged, actuated condition and an uncharged, unactuated condition; and

providing respective charge control signals to respective said first control signal inputs to control the extent of charge placed on respective said capacitances by the time that the respective said first switch connects said electrical signal to the respective said electrically actuated displacement device.

35. (new) The apparatus of claim 34 further comprising:

for each said droplet ejection device, using a second switch that has a second input connected to a discharging electrical terminal, a second output connected to said electrically actuated displacement device, and a second control signal input to determine whether said second input is connected to or disconnected from said second output; and

providing respective discharge control signals to respective said second control signal inputs to control discharge of the charge on said respective capacitances.